1. Summary

1.1 Background and Current Treatment

The City of Rehoboth Beach Wastewater Treatment Plant (RBWWTP) receives wastewater from the City and surrounding areas of Henlopen Acres and Dewey Beach and discharges the treated effluent to the Lewes-Rehoboth Canal. The original RBWWTP was completed in 1989 and was upgraded in two phases, in 1994 and 1997, to reduce the nitrogen and phosphorus discharge as required. Minor upgrades were also implemented at the plant in 2002 to improve grit removal.

The RBWWTP is an advanced secondary treatment plant that produces an effluent of higher quality than that of a typical secondary treatment plant. The RBWWTP is currently meeting and achieving higher levels of treatment than required by the current existing permit limits with effluent concentrations and loading well below the permitted amounts. The design capacity of the RBWWTP is considered adequate, and there are no plans to expand the capacity either now or in the future.

1.2 Project Need

Section 303(d) of the Federal Clean Water Act requires states to identify water bodies that do not meet water quality standards and to impose a Total Maximum Daily Load (TMDL) on both the point and non-point sources that discharge to the water bodies that do not meet the water quality standards for its intended use (USEPA 2002). Water quality monitoring performed by the federal government, the State of Delaware, citizen monitoring groups, and various university and private researchers have shown the Inland Bay (Rehoboth Bay and Indian River Bay), which the Lewes-Rehoboth Canal empties into, to be highly enriched with nitrogen and phosphorus (DNREC 1998). High levels of nutrients lead to eutrophication or the excess growth of algae, which is severely detrimental to water quality. Thus, in 1996, Rehoboth Bay was listed as water quality limited by DNREC and required the development of a TMDL.

The TMDL was issued in December 1998 and required that “all point source discharges which are currently discharging into the Indian River, Indian River Bay, and Rehoboth Bay and their tributaries shall be eliminated systematically” (DNREC 1998). In December 2002, the terms of the consent order, which addressed the TMDL were finalized between the City of Rehoboth Beach and DNREC, and a revised discharge permit for the RBWWTP was issued in August of 2005. As stated in the plant’s discharge permit, the consent order establishes a firm date of December 31, 2014 for the discharge to be eliminated from Rehoboth Bay and the new discharge method to be fully operational (USEPA 2005a). To meet the consent order and revised discharge permit, the need for an alternative method of discharge at the RBWWTP was identified.

1.3 Project Purpose and Scope of Environmental Impact Statement

The purpose of the document is to complete an Environmental Impact Statement (EIS) for the proposed project in accordance with the Environmental Review Procedures of the Delaware Water Pollution Control Revolving Loan Fund (WPCRLF) as directed by DNREC. The goal is to determine if the preferred alternative

can be supported by the regulatory agencies and public, and if found to be environmentally and socially acceptable, to obtain a Record of Decision in support of the ocean outfall alternative.

Several studies evaluating alternative methods of discharging the treated effluent from the RBWWTP in accordance with the requirements of the consent order have been completed (Stearns & Wheler 2005) (Stearns & Wheler 2009) (Whitman, Requardt & Associates, LLP 2009). These studies have led to consensus by the City that the preferred alternative is to build an ocean outfall for the discharge of treated effluent. This conclusion is based on not only the cost impact to the residents of Rehoboth Beach and the surrounding service areas but also the environmental impact associated with each alternative. Several of the alternatives were determined to be technically not feasible or to have excessive risk.

This EIS document compares the six alternative methods of treated effluent disposal at RBWWTP detailed above through an Alternative Analysis, and focuses on an ocean outfall as the preferred alternative. For the three alternatives determined to be technically feasible, this document presents the effected environment, environmental impacts (both positive and negative), and proposed mitigation methods. A cost benefit analysis for these three alternatives was also performed and is included in (Appendix B).

1.4 Alternative Analysis

1.4.1 Alternatives Considered

A total of six (6) alternatives were identified for consideration through discussions with the City, the County and DNREC. These alternatives are briefly described as follows:

Alternative 1: No Action: Treated effluent continues to be discharged into the Rehoboth Bay.

Alternative 2: Nutrient Trading: Treated effluent continues to be discharged into the Rehoboth Bay. The plant offsets effluent nutrient loads by purchasing credits from non-point sources in the Rehoboth Bay watershed. The consent order finalized in December 2002 would only allow credit offsetting if no other options were technically or economically feasible.

Alternative 3: Land Application: Treated effluent is sprayed on agricultural land to irrigate crops and provide nutrients as required for crop uptake. The effluent, with nutrients not taken up by the crops, percolates through the soil to the groundwater. Several variations of this alternative were evaluated including:

Alt. 3A: Treated effluent from Rehoboth Beach is sent to a new facility built for the sole use of the RBWWTP.

Alt. 3B: The RBWWTP is shut down and all raw wastewater is sent to the Wolfe Neck Regional Wastewater Facility (WNRWF) with excess flow treated at the Inland Bays Regional Wastewater Facility (IBRWF).

Alt. 3C: The RBWWTP is shut down and all raw wastewater is sent to the WNRWF with excess flow treated by a Private Wastewater Provider (PWWP).

Alt. 3D: The RBWWTP remains in service and treated effluent is sent to the WNRWF for disposal via spray irrigation, with excess flow sent to the IBRWF.

Alt. 3E: The RBWWTP remains in service and treated effluent is sent to the WNRWF for disposal via spray irrigation, with excess flow sent to a PWWP.

Alternative 4: Rapid Infiltration Beds: Treated effluent is flooded on to sand beds allowing the water to percolate down into the groundwater. The basins are typically flooded and then allowed to dry and rest for a period of time. A minimal amount of additional treatment is achieved through filtration, but the treatment level is much less than provided by spray irrigation,

Alternative 5: Ground Water Injection: Treated effluent is injected into the groundwater. Two variations of this alternative were evaluated including:

Alt. 5A: Treated effluent is injected into a shallow well in an area where the groundwater is contaminated.

Alt. 5B: Treated effluent is injected through a deep well into an aquifer that is confined below the drinking water aquifers.

Alternative 6: Ocean Outfall: Treated effluent is discharged through an outfall and diffuser into the ocean at a depth and distance from the shore that allows adequate mixing with the sea water such that all water quality criteria and public health standards are achieved.

1.4.2 Comparison of Alternatives

Table 1-1 presents a summary of this discussion and the resulting conclusions regarding the suitability of each alternative.

The subjective analysis indicates a generally favorable rating for the ocean outfall alternative compared to the other alternatives. During the completion of the various studies since 1998 when the City was notified that an alternative discharge would be required, there has been an extensive effort to provide information to the public regarding the various alternatives. The outreach has been in the form of workshops, newspaper articles, presentations to various organizations and public hearings. These efforts have allowed an informal consensus to be reached by the City and the citizens with the result that the ocean outfall is the preferred alternative. While there do exist certain groups that oppose the ocean outfall alternative, most citizens of Rehoboth Beach are in favor of this alternative because the cost per user is low, and it provides an independence for the City not attainable with the alternatives that require cooperation with the county and/or a private utility.

Table 1-1 Summary of Alternatives

Alternative	Advantages	Disadvantages
1. No Action	No capital investment required Operating costs remain constant	Water quality of Rehoboth Bay would continue to deteriorate Violates consent order, resulting in significant legal fees and fines
	Conclusion: Does not meet TMDL established by DNREC and would result in legal action being taken against the City.	

Alternative	Advantages	Disadvantages
2. Nutrient Trading	No capital investment required	Not a long term solution
	Net reduction in Inland Bay Sub-basin nutrient loading	Significantly increases annual operating costs
		Non-point sources have already been required to significantly reduce loading according to the TMDL
		Highly dependent on available of non-point sources in the future
		Difficult to maintain
	Conclusion: Infeasible due to lack of available nutrient credits within the Inland Bay Sub-basin.	
3. Land Application	Well established and accepted practice in Delaware	Lack of available land
	Recharges groundwater	High cost of property
	Preserves agricultural use of land	Significant effluent wastewater storage volume required
		Use of existing WNRWF spray irrigation facilities would require coordination with Sussex County including capital improvements to County WWTPs
		Potential to continue discharge of nitrogen into Inland Bay via groundwater
		City essentially operating two treatment facilities
	Conclusion: Land not available. Alternative possible only if cooperation with County at significantly higher cost. City and County rejected regional solution.	
4. Rapid Infiltration Beds	Proven technique for effluent disposal	Potential to contribute nutrients to Inland Bays through groundwater migration and contact with surface water
	Recharges groundwater	
	Relatively low impact in terms of amount of land required and cost	Potential for local mounding of groundwater
	Easy to operate	Lack of available land
	Relatively inexpensive	Use would prevent public access to land
	Conclusion: Land not available and significant environmental concerns including ground water mounding and nutrient transport to Inland Bays.	

Alternative	Advantages	Disadvantages
5A. Shallow Well Injection	Significantly less land requirements Recharge groundwater	Nutrient transport ultimately into Inland Bays Complex operations High level of pretreatment required (drinking water standards) Periodic maintenance required (acid cleaning) Unknown aquifer hydraulic capacity Significant risk of mounding based on RIB data Potential increase of nitrates in groundwater No salt water intrusion aquifers available Pilot borings required to characterize well and aquifer
	Conclusion: No appropriate aquifer available and would result in nutrient transport to Inland Bays through groundwater.	
5B. Deep Well Injection	Significantly less land requirement No potential for ultimate discharge to surface water Primary drinking water standards not required	Complex operations High level of pretreatment required including filtration and chlorination Periodic maintenance required Unknown subsurface below 900 ft Unknown aquifer hydraulic capacity Pilot borings required to characterize well and aquifer No qualified local contractor No groundwater recharge High Risk
	Conclusion: Excessive risk and cost.	
6. Ocean Outfall	Minimal operational requirements Minimal maintenance requirements No potential nutrient transport into Bay	Public acceptance by certain groups may be difficult Permitting issues No groundwater recharge

Alternative	Advantages	Disadvantages
	Conclusion: Most practical solution considering the availability of land and the protection of groundwater and water quality of the Inland Bays. Also, this alternative has the lowest impact on estimated user charges and greatest acceptance by citizens of Rehoboth Beach.	

1.5 Proposed Action

1.5.1 Recommended Plan

The most technically feasible, cost effective and environmentally friendly alternative for the City of Rehoboth is a dedicated ocean outfall (Alternative 6).

A summary of the primary reasons for selecting this alternative follows:

- Due to the 2002 consent order, the No Action alternative is not feasible and would likely result in legal action taken by DNREC against the City.
- The Nutrient Trading option is infeasible because trading partners in the watershed are limited.
- Land application is not a feasible alternative because the required land was not available and working with the county was determined not to be feasible. It was also significantly more costly than the ocean outfall alternative. However, as a point of comparison, the land application alternative is considered as a possible alternative in the environmental impact evaluation.
- Rapid Infiltration Beds were dismissed because of the lack of required land, potential groundwater mounding issues, and the continued introduction of nutrients into the groundwater.
- Subsurface injection is not a viable alternative because of the lack of a suitable aquifer and the significant risk associated with this approach.
- Computer modeling of the outfall indicates that, even under worst-case scenarios regarding the performance of the wastewater treatment plant, public health requirements are met at or in close proximity to the diffuser.
- After a number of public workshops and hearings, the ocean outfall emerged as the alternative preferred by the citizens of the City of Rehoboth Beach for various reasons associated with environmental issues and cost.
- The outfall is the most favorable alternative on a long term present worth basis. After the initial 20 years of operation, the City would have paid off the debt and would only have O&M costs remaining into the continuing years. The land application alternatives would require the City to make payments to the County or to a private utility (or both) in continuing years.

1.5.2 Wastewater Treatment Plant

A new effluent pumping station would be required at the RBWWTP to pump the treated effluent through the force main and outfall pipe to the outfall diffuser. The pumping station would be constructed within the site limits of the existing WWTP and would not require expansion or the acquisition of new land.

1.5.3 Force Main

The pipeline from the RBWWTP to the ocean outfall was sized to handle the summer peak flow of 7.2 MGD. A detailed alignment study was completed to determine the best routing of the force main considering such issues as cost, environmental issues, permitting, potential interferences, traffic control and public concerns. The preferred alignment was selected based on the recommendations of the Rehoboth Beach Wastewater Treatment Plant Effluent Force Main Alignment Study attached in (Appendix G).

The proposed alignment for the force main is shown in Figure 1-1 and will predominately follow existing utilities and right of ways.

Figure 1-1 Force Main Plan

Two construction techniques will be utilized for construction of the force main. They include:

- Horizontal Directional Drill (HDD)
- Open Cut Installation

The extent to which each method is proposed to be utilized is based on the desire to avoid disturbances to trees and historical sites and minimize conflicts with existing utilities, while also minimizing cost.

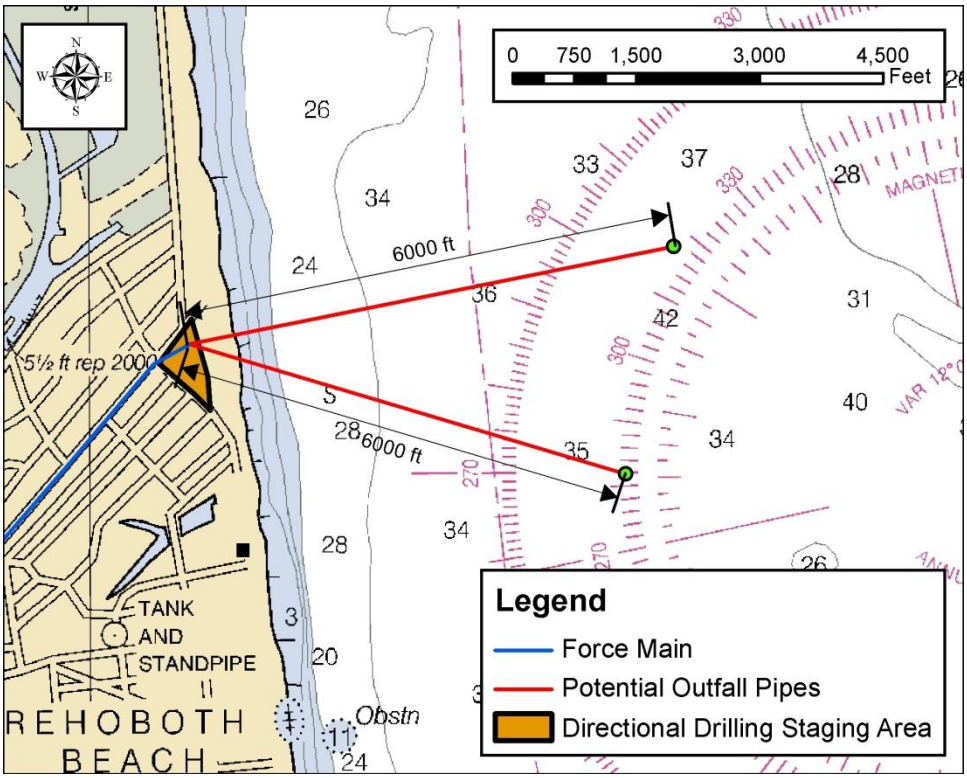
1.5.4 Ocean Outfall

Two specific locations within this general area are investigated in this report as potential outfall locations. At either location, an outfall pipe would extend 6,000 linear feet (1,830 meters) east from the termination of the land-based force main within Deauville Beach parking area. The ocean outfall pipe would terminate with a diffuser pipe at a water depth of approximately 40 feet (12 meters). The specific locations that were evaluated for the ocean outfall are detailed in Table 1-2 and shown in Figure 1-2.

Table 1-2 Proposed Ocean Outfall Locations

Location	Coordinates	Perpendicular distance from shore
North Location	N 38° 43.787', W 75° 03.505'	5,430 ft (1,660 m)
South Location	N 38° 43.333', W 75° 03.631'	4,430 ft (1,350 m)

Figure 1-2 Proposed Ocean Outfall Locations



Based on the conceptual design, the outfall will be a 24 inch diameter pipe extending 6,000 linear feet (1,830 meters) from the Deauville Beach access parking lot to a diffuser. Several alternative diffuser designs are being considered, but it is anticipated that a straight line linear diffuser will provide the most effective mixing.

The concept on which the EIS is based includes a combination of HDD and excavation. HDD would be used to install the outfall from the shore location in the parking lot area west of the dunes as far east towards the diffuser as is technically feasible. In order to be conservative with respect to expectation for HDD, it is proposed that the pipe be installed by HDD to a point approximately 3,000 feet (915 meters) from the staging area. This would, at a minimum, avoid impacts associated with construction through the dune area, beach and surf zone. However, upon review of the obtained boring data, a contractor familiar with this type of construction has indicated that it is highly probable that the HDD portion of the outfall installation could extend beyond the 3,000 feet (915 meters) (Mears Group, Inc 2011a).

Initially, the drill pit is established in the parking lot area and the drilling rig and associated equipment mobilized to the site. A jack-up (lift) barge, stabilized by anchor, is mobilized to the offshore location to serve as the platform for the offshore drilling rig. At the mid-point of the outfall installation (approximately 3,000 feet (914 meters) offshore) the outfall would reach the surface of the seabed. The remaining outfall pipe would be constructed using excavation and backfill techniques. Most likely a bucket type or clamshell excavator would be required since it is best suited for detailed excavation.

1.6 Effluent Characteristics and Concerns

Treated effluent from a wastewater treatment plant may contain minimal quantities of many different substances that could impact physical, biological, and/or human environments when it is discharged. Of primary concern are:

- Nutrients
- Bacteria
- Metals, Volatiles, Semi-Volatiles, Phenolics, and Polychlorinated Biphenyls (PCBs)
- Pharmaceuticals and Personal Care Products (PPCPs)

1.6.1 Nutrients

Delaware surface water standards require nitrogen and phosphorus concentrations within Rehoboth Bay to be below submerged aquatic vegetation growth season average levels of 0.14 mg/L TN and 0.01 mg/L TP (DNREC 2004). It is assumed that once nitrogen and phosphorus levels within the effluent dilute to this level, the impact on the environment is minimal. No regulations or standards exist for nitrogen and phosphorus concentrations within the ocean, however background nutrient concentrations of 0.37 mg/L TN and 0.06 mg/L TP should be met after dilution. The average concentration of Total Nitrogen and Total Phosphorus (January 2007 – July 2010) was 6.2 mg/L TN and 0.35 mg/L TP. To achieve surface water standards for nitrogen and phosphorus, the effluent must undergo at least a 1:45 dilution. To reach background nutrient levels within the ocean, the effluent must undergo at least a 1:17 dilution.

1.6.2 Pathogenic Organisms

The WWTP is required by its NPDES permit to reduce the level of enterococcus to less than 14 colonies per 100 mL. The discharge limit is more stringent than the standard required for primary contact in marine waters. The RBWWTP typically performs at a higher level than the required standard, reducing enterococcus levels to well below the maximum allowable value. Effluent enterococcus levels measured at the plant from 2007 and 2009, was often zero with a geometric mean of 2, although one sample was as high as 40 colonies per 100 mL.

1.6.3 Metals, Volatiles, Semi-Volatiles, Phenolics, and Polychlorinated Biphenyls (PCBs)

Thirteen (13) metals were analyzed in the three effluent samples (see (Appendix F)). In every case the metals were either below detection limits or were present at concentrations substantially below the level of concern as listed in the Surface Water Quality Standards, even under the more stringent limits imposed on surface waters classified as Public Water Supply Sources (Fish & Water Ingestion). With the exception of copper, all of the detections are less than the applicable water quality criteria for the protection of aquatic life. The detected concentration of 7.0 µg/L copper must undergo at least 1:3 dilution to achieve the required 3.1 µg/L concentration.

Thirty-four (34) volatile organic compounds were analyzed in the three effluent samples (see (Appendix F)). Of the 102 possible detections, there was only a single detection of chloroform. The California EPA lists a lowest observed effect level (LOEL) of 6,400 µg/L for chronic effects to saltwater species (California EPA 2011). The concentration of chloroform identified by Delaware's Surface Water Quality Standards imposed on surface waters classified as a public water supply is 340 µg/L chloroform (DNREC 2004). The single detection of 1.1 µg/L of chloroform is orders of magnitude less than both of these criteria.

Fifty-four (54) separate semi-volatile organic compounds were analyzed in the three effluent samples. Out of the 162 possible detections, there was only a single detection of bis(2-ethylhexyl) phthalate (BEHP). The concentration of BEHP identified by Delaware's Surface Water Quality Standards imposed on surface waters classified as a public water supply is 2.2 µg/L chloroform (DNREC 2004). The detected concentration of 8.0 µg/L of BEHP must undergo at least 1:4 dilution to achieve the required concentration limit.

Of the three samples taken, only one sample contained a detectable level of phenolics with a reported concentration of 5 µg/L. It is not unusual for phenolics as a class to be detected in effluent, and there is no water quality criterion for phenolics as a class.

The City of Rehoboth Beach collected a 24-hour composite sample of the RBWWTP effluent which was sent to the lab to be analyzed for PCBs using EPA Method 1668A. The PCB congener results are presented in (Appendix I). The concentration of total PCB in the RBWWTP effluent was 425 pg/L. The PCB concentration in the effluent is well below DNREC's marine chronic aquatic life criterion of 30,000 pg/l (DNREC 2004), even without the benefit of any near-field or far-field dilution in the receiving water.

1.6.4 Pharmaceuticals and Personal Care Products (PPCPs)

No direct analysis of pharmaceuticals and personal care products (PPCPs) in RBWWTP effluent was performed. Since the service area of RBWWTP is primarily residential with some light commercial consisting

of shops and restaurants, it is expected that the concentration of pharmaceutical in its effluent will be very low (1 ppb).

1.7 Ocean Modeling

To help understand and predict the environmental impacts of this alternative, two numerical ocean circulation and plume dispersion models were developed by GHD and calibrated using published and collected field data. The models estimate the rate at which treated effluent will dilute at the point of discharge (near-field) and the far-field fate of the effluent as it migrates away from the zone of initial mixing and dissipates. The modeling report and corresponding results are included in (Appendix J).

Data required to calibrate and validate the hydrodynamic model was collected in 2010 and 2011. The data collection effort targeted two potential outfall sites referred to as northern and southern outfalls and was organized in two long-term field monitoring campaigns and six short-term intensive periods of measurement.

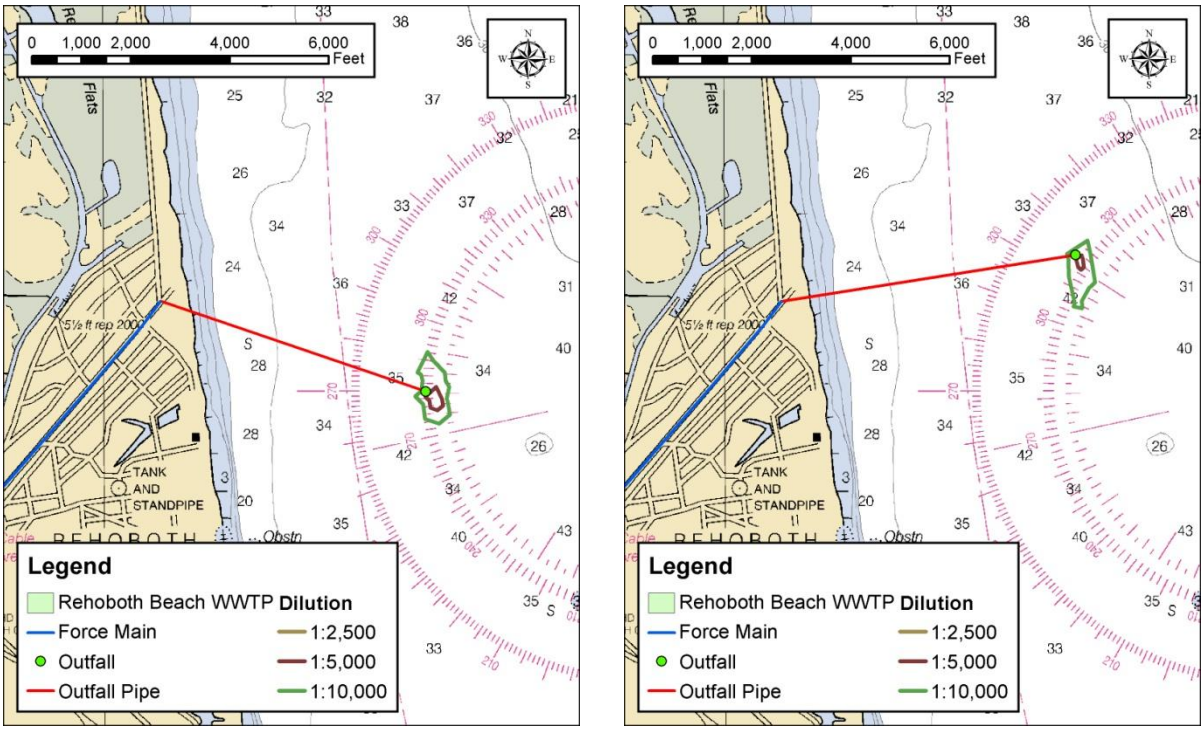
The simulation domain of the far-field model includes the entire Delaware estuary and 233 miles (375 km) of the adjacent continental shelf extending some 65 miles (105 km) offshore to maximum depths of approximately 330 ft (100 m). The included section of continental shelf stretches from the mouth of the Delaware estuary 100 miles (160 km) north past Bamegat Bay reaching Point Pleasant Beach and 135 miles (215 km) to the south ending at Cape Charles at the mouth of Chesapeake Bay.

Based on the far-field analysis of effluent plume advection and dispersion for both potential outfall locations (north and south) it is observed that both plume footprints, as identified by the 10,000:1 dilution contour shown in Figure 1-3:

- Form offshore and remain in the vicinity of their respective sources;
- Assume somewhat elongated shapes with a major axis running parallel to the coast;
- Are subject to the variation in magnitude of the combined effects of the driving forces (tide, winds, waves and freshwater inflows); and
- Are not predicted to reach the coast.

Because of the similarity of the results at the northern and southern outfall locations, the choice of outfall site can be based on factors other than hydrodynamics and dilution.

Figure 1-3 Contour plots showing the 95th percentile of dilution after 11 month of outfall operation at Southern and Northern Outfall Locations



Near-field dilution performance has been simulated based on the preliminary linear diffuser design. Nine simulations in total were conducted. The modeled cases investigated the effect of ambient current speed, ambient vertical density stratification and also the effect on dilution by increasing the length of the diffuser. The following conclusions can be derived from this study

- Overall, a high level of dilution should be achieved.
- The linear diffuser achieved a dilution in excess of 1:250 for an unstratified ocean with close to zero ambient current magnitudes.
- Vertical density stratification provides some limitation to mixing, though this appears unlikely to lead to any impact of consequence.
- There is potential merit in doubling the length of the diffuser (Case 005) while reducing the number of ports per riser to two as this diffuser offers better dilution compared to the preliminary design. The longer diffuser can potentially help overcome the mixing constraints when the water column is density stratified.

1.8 Affected Environment and Environmental Consequences (Physical Environment)

1.8.1 Compared alternatives

Under the no action alternative, treated effluent continues to be discharged into the Lewes-Rehoboth Canal through the current outfall. This is not a feasible option since it would violate the consent order requiring the elimination of all point discharges into the Inland Bays, which includes Rehoboth Bay. The environmental impacts of this alternative were investigated in detail to provide a point of comparison to the ocean outfall alternative.

Under the land application alternative, treated effluent is pumped from RBWWTP to a spray irrigation facility to be land applied. None of the five land application alternatives originally considered were determined to be feasible, since insufficient land was determined to be available and cooperation with Sussex County is no longer expected to occur. In order to provide a point of comparison to the ocean outfall alternative, the environmental impacts of a dedicated land application facility were investigated in detail, as this is the option that would potentially have the greatest impact on the environment.

Under the ocean outfall alternative, treated effluent is pumped from RBWWTP to an ocean outfall located more than a mile off coast in the Atlantic Ocean. Two potential locations were considered for the ocean outfall, both extending out from the beach access parking lot located at the intersection of Henlopen Ave and Duneway. Only one of the two proposed outfall pipe and outfalls will be constructed. An ocean outfall is the only feasible option and the preferred alternative.

1.8.2 Air Quality/Odor

Short term / temporary impacts to air quality/odor are expected for the land application and ocean outfall alternatives due to construction vehicles and equipment.

Long term / chronic impacts to air quality/odor are expected for the no action alternative due to algae produced by eutrophication.

1.8.3 Soils/Groundwater

Minor short term impacts to soil are expected for the land application and ocean outfall alternatives due to disturbance from construction.

Potential long term / chronic impacts to soils/groundwater may result from the land application alternative, due to the possible spread of pathogenic microorganism though soil and ground water. Delaware regulations require that both soil and groundwater influenced by land application effluent be regularly tested (DNREC 1999).

1.8.4 Surface Water Quality/Quantity

Minor short term impacts to surface water quality are expected for the land application and ocean outfall alternatives due to increased erosion and sedimentation during construction. Silt fencing and other erosion control methods would effectively mitigate this impact. For the ocean outfall alternative, trenching in the

ocean will agitate the ocean floor, which may temporarily increase turbidity and release biological and chemical substances that have settled into the sediment. Soil data indicates that impacts from turbidity should be localized and minimal. The potential for the release of drilling fluid into the ocean when utilizing directional drilling during a “frac-out” will be minimized by carefully monitoring of the drilling fluid pressure during drilling.

1.8.5 Floodplains

Minor short term impacts to floodplains are expected for the land application and ocean outfall alternatives due to disturbance from construction. No long term impacts are expected from any alternative.

1.8.6 Prime Agricultural Land

Potential short term impacts to prime agricultural land may result from the land application alternative due to disturbance for construction of the force main. The force main will follow existing roadways and construction will not have a significant impact on the nearby farmland.

No alternative will encourage any growth or development that could infringe upon agricultural land since no alternative will increase the treatment capacity of the RBWWTP.

1.8.7 Cumulative Effects to the Physical Environment

The current poor physical state of Rehoboth Bay is directly due to the cumulative impact of nutrients discharged from multiple point and non-point sources within the watershed. RBWWTP effluent, a point source, currently discharges into the Bay and contributes to the poor water quality; however, non-point discharges from agricultural operations are the leading source of nutrients (Martin, et al. 1996). Continuing to discharge into the Bay will likewise continue to contribute to the poor water quality

The land application alternative is not expected to contribute to any cumulative effect on the physical environment. Adequate land is not available for just the construction of a land application facility for Rehoboth Beach, so it is extremely unlikely that additional land application facilities for other treatment plants would be built in the area. Additionally, the buffer zone required around land application facilities minimizes the cumulative effect of multiple facilities.

No ocean outfalls currently exist off the coast of Rehoboth Beach, and there are no known plans to construct additional outfalls in the near future. The South Coastal WWTP ocean outfall, located off the coast of Bethany Beach, is the closest existing outfall to the proposed RBWWTP outfall at 13 miles (21 km). Due to the distance between effluent outfalls and the rapid dilution of treated effluent within the ocean, the RBWWTP ocean outfall is not expected to contribute to any cumulative impacts in the area.

1.9 Affected Environment and Environmental Consequences (Biological Environment)

1.9.1 Terrestrial Biota/Habitat

Potential short term impacts to terrestrial biota/habitat may result from the land application alternative. The proposed alignment crosses over creeks associated with rare, threatened and endangered species that could be indirectly impacted from sediment. Stringent erosion and sediment controls would be required to minimize impacts. Several species of nesting migratory birds, may be using area along the force main alignment as a nesting ground. If a visual survey confirms a substantial number of nests, construction should be restricted to between August 1 and April 15, or deterrents such as mesh netting should be used (Stetzar 2011). Potential short term impacts to terrestrial biota/habitat may also for the ocean outfall alternative. Impacts to the lower and upper beach areas, dunes, the intertidal zone, and their associated terrestrial species are not anticipated since the pipeline will be directional drilled in those areas and construction of the force main from RBWWTP to the ocean outfall will have minimal environmental impact because the alignment will follow existing utilities and roadways.

Potential long term impacts to terrestrial biota/habitat may result for the land application since a portion of the proposed land application site is mapped as a Key Wildlife Habitat by the Delaware Wildlife Action Plan, indicating that it is an area of the state where conservation efforts should be focused (Allen, Barkus and Bennett 2006). However, this designation is not-regulatory, and impact to species from effluent is not expected.

1.9.2 Wetlands Biota/Habitat

Potentially significant impacts to wetland biota/habitats may exist for the land application alternative if constructed at the proposed location as freshwater forested/shrub wetlands and freshwater emergent wetlands are located there.

No long term impacts to wetlands biota/habitat are expected from any alternative.

1.9.3 Aquatic Biota/Habitat

1.9.3.1 Benthic Biota

Minor short term impacts to benthic biota are expected for the ocean outfall alternative in the vicinity of the outfall diffuser or the trenched portion of the outfall pipe due to dredging and backfill operations as the diffuser is installed. Benthic communities in the disturbed area are initially decimated but resettling and recolonization occur rapidly. Benthic biota sampling would be done before and after construction to determine what effect, if any, construction had on the benthic community.

Minor long term impacts to benthic biota may result from the ocean outfall alternative in the vicinity of the ocean outfall. Previous studies show that the community composition in the near field area showed the greatest discharge related effects, but biota diversity remained high, and the area was not characterized by a degraded community (Diener, et al. 1995).

1.9.3.2 Phytoplankton

Minor short term impacts to phytoplankton may occur for the ocean outfall alternative. Construction of the trenched portion of the outfall pipe will increase local turbidity, which could impact the ability of phytoplankton to receive sunlight for photosynthesis. The potential mortality of phytoplankton caused by construction activity would not be as great as the natural mortality rates under normal circumstances (Louis Berger Group, Inc. 1999).

Major long term impacts to phytoplankton in Rehoboth Bay would result from the no action alternative. Nutrient over enrichment within the bay would continue to cause phytoplankton blooms, which are damaging to the local ecosystem.

1.9.3.3 Submerged Aquatic Vegetation (SAV)

Short term impacts to submerged aquatic vegetation (SAV) are not expected for any alternative.

Major long term impacts to SAV in Rehoboth Bay would result from the no action alternative. The excessive growth of phytoplankton and seaweed resulting from eutrophication block sunlight from reaching SAV on the bay bottom.

1.9.3.4 Fish

Minor short term impacts to fish may occur for the ocean outfall alternative. Dredging within the ocean could cause physical injury to fish either directly by physical contact or indirectly by disrupting the food resources. Significant impacts to Essential Fish Habitats (EFHs) are not expected as all of the fish species associated with the area of concern are highly mobile and migratory, and all EFHs near the project extend far beyond the area. Construction activity will, at most, only disturb a small fraction of the total EFH area.

Long term impacts to fish are not expected to occur for the ocean outfall alternative. All of the fish species associated with the area of concern are highly mobile and migratory, and all EFHs near the project extend far beyond the area. Any contaminant potentially present is rapidly diluted to below minimum water quality standards or to non-detectable levels.

1.9.3.5 Marine Mammals

Minor short term impacts to marine mammals may occur for the ocean outfall alternative. Construction during winter months will minimize impact to bottlenose dolphins. No construction will occur on the dunes or beach, so impacts to seals from construction equipment is not expected. Equipment for construction should be selected to minimize sound intensity and duration to prevent affecting the acoustic ability or injuring the hearing organs of marine mammals (Stetzar 2011).

Long term impacts to mammals are not expected to occur for the ocean outfall alternative. All of the fish species associated with the area of concern are highly mobile and migratory, and all mammals near the project extend far beyond the area. Any contaminant potentially present is rapidly diluted to below minimum water quality standards or to non-detectable levels. Bioaccumulation of contaminants from RBWWTP effluent within marine mammals is not expected to occur.

1.9.4 Endangered Species

1.9.4.1 Sea Turtles in Delaware

Minor short term impacts to sea turtles may occur for the ocean outfall alternative from the use of dredging equipment for construction of the outfall. Use of clamshell or cutter suction dredger (CSD) equipment and construction during winter months would minimize impact to sea turtles.

Long term impacts to sea turtles are not expected to occur for the ocean outfall alternative. The sea turtles associated with the area of concern are mobile and migratory and thus exposure to any contaminant is expected to be transient and minimal. Any contaminant potentially present is rapidly diluted to below minimum water quality standards or to non-detectable levels.

1.9.5 Cumulative Effects to the Biological Environment

The current poor physical state of Rehoboth Bay is directly due to the cumulative impact of nutrients discharged from multiple point and non-point sources within the watershed. RBWWTP effluent, a point source, currently discharges into the Bay and contributes to the poor water quality; however, non-point discharges from agricultural operations are the leading source of nutrients (Martin, et al. 1996). Continuing to discharge into the Bay will likewise continue to contribute to the poor water quality

The land application alternative is not expected to contribute to any cumulative effect on the physical environment. Adequate land is not available for just the construction of a land application facility for Rehoboth Beach, so it is extremely unlikely that additional land application facilities for other treatment plants would be built in the area. Additionally, the buffer zone required around land application facilities minimizes the cumulative effect of multiple facilities.

No ocean outfalls currently exist off the coast of Rehoboth Beach, and there are no known plans to construct additional outfalls in the near future. The South Coastal WWTP ocean outfall, located off the coast of Bethany Beach, is the closest existing outfall to the proposed RBWWTP outfall at 13 miles (21 km). Due to the distance between effluent outfalls and the rapid dilution of treated effluent within the ocean, the RBWWTP ocean outfall is not expected to contribute to any cumulative impacts in the area.

1.10 Affected Environment and Environmental Consequences (Human Environment)

1.10.1 Growth and Development

Minor impacts to growth and development may result from construction of the land application and ocean outfall alternatives. No alternative will encourage any growth or development since no alternative will increase the treatment capacity of the RBWWTP.

1.10.2 Environmental Justice

There is no area with a concentration of low income household that would be impacted by any alternative. Therefore, any adverse impact, if any, would not predominately be borne by a minority population and/or a low-income population. There is no adverse environmental impact anticipated as a result of the proposed

action, construction of an ocean outfall and its supporting facilities. Adverse impacts to terrestrial, wetlands, aquatic, or endangered species are expected to be minimal for the proposed project. Because there would be no adverse environmental impacts, an environmental justice analysis is not required.

1.10.3 Community Facilities

During construction of either the land application or ocean outfall alternative, minor impacts to community facilities may occur due to traffic control along the proposed force mains. However, this impact will be minor, and will be managed to minimize impacts.

None of the effluent disposal alternatives will have any long term impacts on community facilities. Although wastewater treatment is a public utility, all impacts will be downstream of RBWWTP, so public utility service will not be impacted.

1.10.4 Economics

Minor short term economic impacts may result from construction of the land application and ocean outfall alternatives. The adverse effects of construction on local businesses can be mitigated by constructing appropriate pedestrian and traffic controls and rerouting traffic to minimize temporary reduction in access. The local economy relies heavily on tourism during the summer months, and thus construction should be limited to the winter months to avoid impacts to retail sales.

Long term economic impacts may result from all considered alternatives. The no action alternative would allow the water quality in Rehoboth Bay to continue to diminish which could potentially reduce tourism to the area, which is a major component of the local economy. The land set aside for the land application site for that alternative will be prohibited from being used for growing crops and raising livestock for human consumption (DNREC 1999). Since the land required is only a small fraction of the available farm land, the impact to the agricultural industry will be minimal. Negative public perception of the ocean outfall alternative could potentially reduce tourism to the area, and thus have a negative effect on the local economy. However, there was no noticeable difference in tourism to nearby beaches before and after construction of an ocean outfall.

1.10.5 Project Financing

The typical current annual user charge was calculated to be $326 for a residential customer within the City of Rehoboth Beach limits (Stearns & Wheler 2009). According to DNREC guidelines, the maximum “reasonable” user charge is 1.5% of the median household income, which equates to $989 for the City of Rehoboth Beach (Stearns & Wheler 2009).

The estimated user charges for the different alternatives are compared in Table 1-3. A cost benefit analysis for these three alternatives was also performed and is included in (Appendix B).

Table 1-3 Estimated Annual User Charges (Stearns & Wheler 2009)

Alternative	Annual User Charge
Alternative 1: No Action	$326
Alternative 3: Land Application	
3A: Dedicated spray irrigation facility	Unknown[1]
3B: Raw wastewater to WNRWF with excess flow treated at the IBRWF	$1,160
3C: Raw wastewater to WNRWF with excess flow treated by a PWWP	$1,430
3D: Treated effluent to WNRWF with excess flow sent to the IBRWF	$1,014
3D: Treated effluent to WNRWF with excess flow sent a PWWP	$1,420
Alternative 6: Ocean Outfall	$635

Note:

1. Because of unknowns associated with acquisition of land and construction of a spray irrigation facility, the annual user charges for this option were not calculated.

1.10.6 Public Health

Construction of the land application and ocean outfall alternatives would have the negligible effects on public health that is inherent to all construction activity.

Long term public health impacts may result from all considered alternatives. The no action alterative would contribute to algae blooms in Rehoboth Bay, which can produce toxins harmful to humans. Under the land application alterative, contamination of groundwater with nitrate, pathogenic organisms, or metals is not expected, since concentrations in the effluent are below the applicable standards/limits for human health. Public exposure to aerosols containing pathogenic organisms or other contaminants would be limited since public access to the application site would be restricted. Under the ocean outfall alternative, public exposure to contaminants within effluent is not expected since concentrations within the effluent is reduced to contaminate standards/limits within zone of initial dilution.

1.10.7 Noise

Minor short term noise impacts may result from construction of the land application and ocean outfall alternatives.

Minor long term noise impacts may result from operation of the land application facility.

1.10.8 Historic/Archeologic

Historic/Archeologic effects may result from construction of the land application and ocean outfall alternatives. Construction of the force main for either alternative in the vicinity of a historical site will require mitigation techniques, including, but not necessarily limited to, utilizing directional drilling methods. Impact to submerged cultural resources many also occur for the ocean outfall alternative. A magnetometer and side-scan sonar survey was performed by Tidewater Atlantic in the vicinity of the potential ocean outfall from July 11 to July 15, 2011. This report is included in (Appendix O) of this report. One target area with potentially significant cultural resources was identified near the end of the southern outfall. This anomaly would require additional underwater survey to conclude that it is historically significant. No significant anomalies were associated with the northern alignment and outfall. It is concluded that the northern outfall would have the least impact to cultural resources.

No long term historic/archeologic effects are expected from any alternative.

1.10.9 Aesthetics/Recreation

Minor short term impacts to the public's recreational usage of nearby beaches may result from construction of the land application and ocean outfall alternatives. The staging area of the directional drilled portion of the ocean outfall alternative is located in a parking lot used by beach goers and would have to be closed during construction. Beach tourism varies by season and is minimal during the winter months. If construction is performed during this time of the year, there would be very little impact to users of the beach.

Long term aesthetic/recreational impacts may result all of the considered alternatives. Under the no action alternative, Rehoboth Bay will continue to be unsuitable for recreational activity, such as fishing and algae blooms and other effects of overenrichment would continue to diminish the aesthetic appeal of the Bay. The facility required for the land application alternative would be highly visible to nearby members of the public, but will be located over five miles inland from the ocean and it is not expected to detract from the current aesthetics of the area. The land will be restricted for use as a land application facility, which will prevent any further development that could potentially diminish the aesthetic appeal of the area. Swimming and fishing in the direct vicinity of the ocean outfall may be prohibited as a precaution, but this would be within a small area located more than a mile off-shore, where it is unlikely that swimming and fishing occur.

1.11 Conclusions and Preferred Alternative

The physical, biological, and human environmental consequences for the no action, land application, and ocean outfall alternatives are presented in Table 1-4.

Figure 1-4 shows the preferred force main alignment and outfall location. The preferred force main is routed along the Lewes – Rehoboth Canal and within the Henlopen Avenue right-of-way to Deauville Beach, and the preferred outfall location is the northern outfall that extends perpendicular from the outfall staging area. The alternative is preferred based on feasibility, cost considerations, and environmental impacts.

Figure 1-4 Preferred Force Main Alignment and Outfall Location

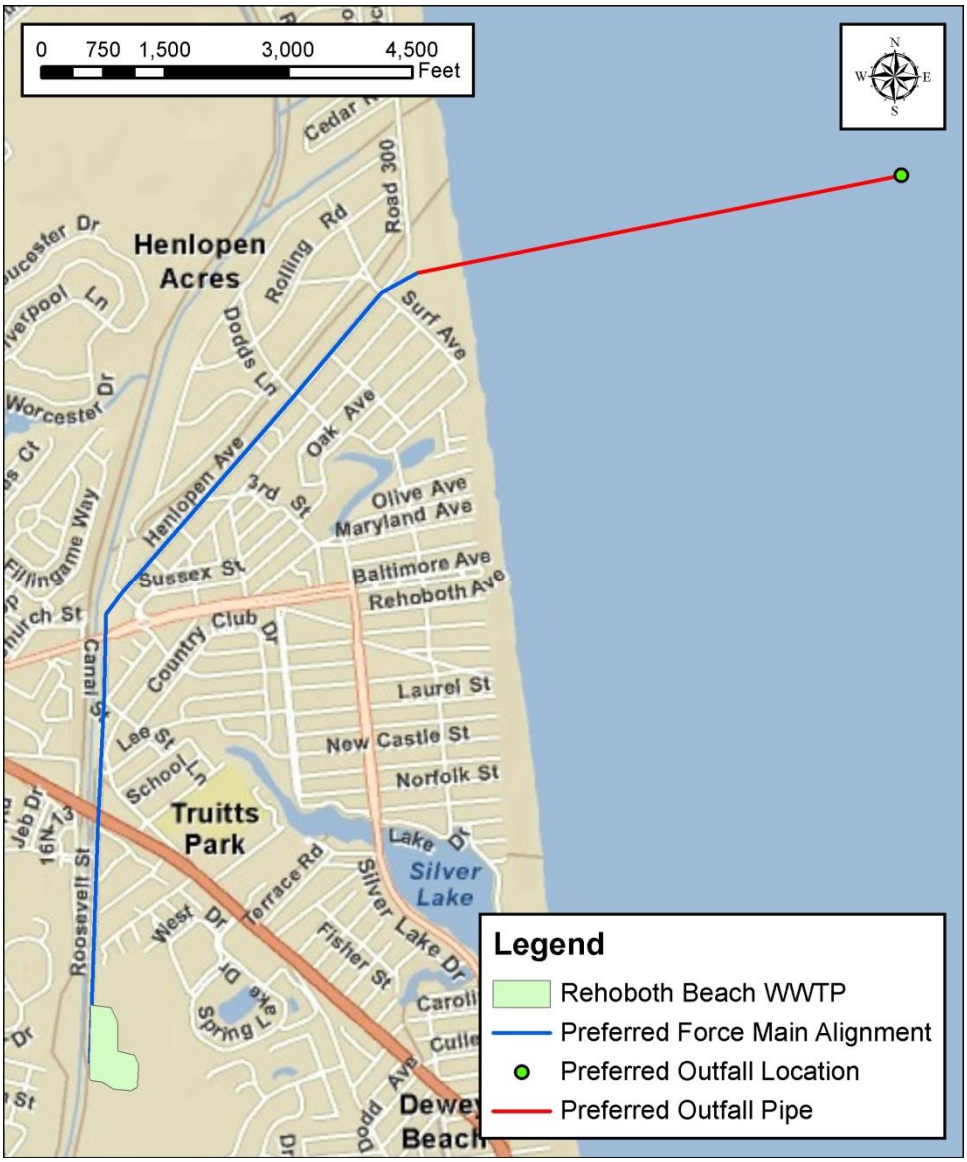


Table 1-4 Summary of Environmental Consequences

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Physical Environment						
Air Quality/ Odor	None.	Emissions of construction vehicles and equipment. *Expected to be minor.*	Emissions of construction vehicles and equipment. *Expected to be minor.*	Hydrogen sulfide odor from rotting algae.	None.	None.
Soils/ Ground-water	None.	Disruption of soils from construction. *Expected to be minor.*	Disruption of soils from construction. *Expected to be minor.*	None.	Contamination from pathogenic microorganisms. *Effluent treated to a high level. Contamination not expected. DE regulations require regular testing of soils and groundwater*	None.

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Surface Water Quality/ Quantity	None.	Increased erosion and sedimentation during construction. *Mitigate with silt fencing and other erosion control methods*	Increased erosion and sedimentation during construction. *Mitigate with silt fencing and other erosion control methods* Potential increased turbidity. *Expected to be localized and minimal.* Potential for frac-out. *Best management practices will be implemented.*	Contribute to eutrophication in Rehoboth Bay.	Nutrients will eventually enter the inland bays.	Contaminants in wastewater enter the ocean. *Effluent treated to a high level. Model predicts rapid dilution to background levels.*
Floodplains	None.	Disruption of 100 yr floodplain along alignment. *Expected to be minor.*	Disruption of 100 yr floodplain along alignment and at HDD staging area. *Expected to be minor.*	None.	None.	None.
Prime Agricultural Land	None.	Potential for impact along forcemain. *Forcemain will follow existing roadways.*	None	None.	Potential for growth and disturbance if treatment capacity increased. *RBWWTP capacity will not increase.*	Potential for growth and disturbance if treatment capacity increased. *RBWWTP capacity will not increase.*

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Biological Environment						
Terrestrial Biota/ Habitat	None.	Alignment crosses creeks associated with rare, threatened and endangered species and nesting areas of migratory birds. *Mitigate with stringent erosion and sediment controls, winter construction, and deterrents such as mesh netting.*	None. *Forcemain predominately follows existing utilities and roadways and will be directionally drilled under sensitive areas.*	None.	Portion of proposed land application site is mapped as Key Wildlife Habitat. *This designation is not-regulatory, and impact to species from effluent is not expected.*	None.
Wetlands Biota/ Habitat	None.	Wetland biota/habitats currently located on the site of the proposed land application facility.	None.	None.	None.	None.
Benthic Biota	None.	None.	Disruption of communities due to dredging. *Benthic resettling and recolonization are expected to occur rapidly. Benthic biota sampling would be done before and after construction.*	None.	None.	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Studies show biota diversity remains high and communities are not characterized as degraded due to effluent discharge.*

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Phyto-plankton	None.	None.	Increased turbidity due to dredging, decreasing sunlight. *Potential mortality due to construction not expected to be greater than natural rates.*	Excessive growth due to eutrophication in Rehoboth Bay, which damages local ecosystem	None.	None. *Effluent rapidly dispersed.*
Submerged Aquatic Vegetation	None.	None.	None.	Sunlight blocked from reaching SAV on the bay bottom due to excessive growth of phytoplankton and seaweed caused by eutrophication.	None.	None.
Fish	None.	None.	Physical injury to fish or disruption of food resources due to dredging. *Fish are highly mobile and migratory. Construction activity will only disturb a small fraction of the total EFH area.*	Decline and loss of fish habitats due to low dissolved oxygen caused by eutrophication.	None.	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Fish are highly mobile and migratory, thus any exposure to contaminant transient and minimal.*

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Marine Mammals	None.	None.	Disruption of communities due to dredging, including sound produced by construction equipment. *Construction during winter months will mitigate impact to dolphins. Seal habitats will be avoided by utilizing HDD. Construction equipment will be selected to minimize sound intensity and duration.*	None.	None.	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Mammals are highly mobile and migratory, thus any exposure to contaminant is transient and minimal. Outfall not located in area of high mammal diversity.*
Sea Turtles	None.	None.	Physical injury due to dredging. Dredging methods will low impact to sea turtles (cl*amshell or CSD) will be used. Construction to during winter months will minimize impact.*	None.	None.	Disturbance from effluent. *Effluent treated to a high level and rapidly diluted. Sea turtles are highly mobile and migratory, thus any exposure to contaminant is transient and minimal.*

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Human Environment						
Growth and Develop-ment	None.	Disruption due to construction. *Expected to be minor.*	Disruption due to construction. *Expected to be minor.*	None.	Potential for growth and development if treatment capacity increased. *RBWWTP capacity will not increase.*	Potential for growth and development if treatment capacity increased. *RBWWTP capacity will not increase.*
Community Facilities	None.	Disruption due to construction. *Expected to be minor.*	Disruption due to construction. *Expected to be minor.*	None.	None. *Public utility service will not be interrupted.*	None. *Public utility service will not be interrupted.*
Economics	None.	Disruption due to construction. *Expected to be minor. Impact to tourism and retail minimized by construction during winter months.*	Disruption due to construction. *Expected to be minor. Impact to tourism and retail minimized by construction during winter months.*	Reduced tourism due to poor water quality of Rehoboth Bay.	Growing crops and raising livestock for human consumption on land application site prohibited. *Land requirements for land application only a small fraction of the available farm land.*	Reduced tourism due to negative public perception. *No noticeable difference in tourism to nearby beaches before and after construction of an ocean outfall.*

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Public Health	None.	Effects inherent to all construction activity. *Expected to be minor.*	Effects inherent to all construction activity. *Expected to be minor.*	Harmful toxins produced by algae blooms resulting from eutrophication in Rehoboth Bay. Public heath concerns of contact with Rehoboth Bay. *Currently closed for swimming.*	Contamination of groundwater with nitrate, pathogenic organisms, or metals. *Concentration in effluent below standards/limits.* Public exposure of aerosol containing pathogenic organisms or other contaminants. *Public access to land application site is restricted.*	Public exposure to contaminants within effluent. *Effluent reduced to contaminate standards/limits within zone of initial dilution*
Noise	None.	Noise from construction. *Expected to be minor.*	Noise from construction. *Expected to be minor. Noise of dredging far offshore and masked by surf background noise.*	None.	Noise of spray irrigation facility. *Expected to be minimal.*	None.

	Potential Short Term / Temporary Impacts			Potential Long Term Impacts		
	No action	Land Application	Ocean outfall	No action	Land Application	Ocean outfall
Historic/ Archeologic	None.	Impact of historical sites along alignment. *Mitigated by utilizing HDD techniques near know sites.*	Impact to historical sites along alignment. *Mitigated by utilizing HDD techniques near know sites.* Impact to submerged cultural resources. *Magnetometer and side-scan sonar survey performed, and no conflict with cultural resources expected.*	None.	None.	None.
Aesthetics/ Recreation	None.	Disruption of beaches along forcemain alignment due to construction. *Expected to be minor.*	Disruption of beaches along forcemain alignment, at staging area, and offshoure due to construction. *Impact minimized by winter construction. Trenching ships and barges far enough offshore to not have direct impact on beach visits.*	Low aesthetic appeal of Rehoboth Bay. Bay unsuitable for fishing and swimming.	Land application facility highly visiable to nearby members of the public. *Facility located 5 miles inland from the ocean. Facility not expected to detract from aesthetics.*	Contaimination of ocean. *Effluent treated to a high level and rapidly diluted. Outfall over a mile from shore, where swimming and fishing is not likely.*